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Tiger Beetle Larvae.

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The Pilgrims in their Progress through the Interpreter's House were shown, among other excellent things in the Significant Rooms, "a man who could look no way but downwards." So busy was he with a muck-rake gathering together straws and sticks, that he never looked up to see an angel standing close by and holding out a crown for him. In spite of the moral of this story, when I want to find tiger beetle larvae I "look no way but downwards." Crowns, which have always been notoriously uneasy headgear, are much out of fashion at present. And if I did look up, I don't believe I would find that angel on the job anyway. So on my summer walks I usually keep my eyes fixed on every sandy path or bare, loamy place I come to, seeking the burrows of the tiger beetle grubs.

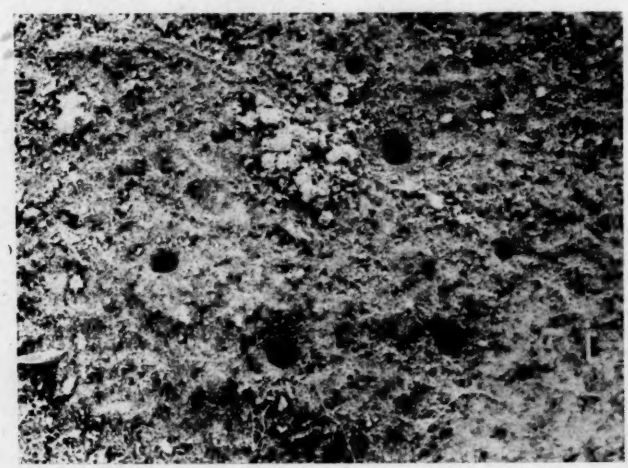

Fig. 1.—Burrows of Tiger beetle larvae.

The burrows look a good deal like ant-holes, but are without the flat cone of excavated earth-particles which always surrounds the mouth of an ant's nest. So clean and smooth is the surface around the opening of a tiger beetle's tunnel that it almost seems as if the insect had accomplished the impossible in beginning at the bottom and digging upwards. The holes may occur singly, or five or six of them an inch or two distant from one another may form a group. In favorable situations there is often a considerable colony of them. Last sum-

mer I found a collection of over 200 burrows in an area of about 10 feet by 20 feet on a sandy farm road in the Township of Fitzroy, County of Carleton, Ontario. This place I called "Tiger Beetle Town," and it was here that I principally studied the habits of the larvae.

You always see the burrows first as empty holes. This is because the exceedingly sharp-eyed occupants saw you coming before you could catch sight of them, and instantly dropped to the bottom of their tunnels, or rather shafts, for the holes go straight downward. But if you sit down, and keeping perfectly still, watch one of the holes, in from one to five minutes the black opening suddenly vanishes. The grub, returning to its steady occupation of lying in wait to seize passing insects, has accurately plugged the hole from within with its flat-topped, sand-covered head, which blends so nicely with the surrounding soil that the opening practically disappears. Raise but a finger and the creature drops again like a shot to the bottom of the shaft, and there is the empty hole once more. A wave of the hand and every tiger beetle larva within thirty feet has disappeared. So incredibly sensitive are they to the slightest movement, that more than once I have scared a larva to the depths merely by turning my eyes to look at him, without any conscious motion of my head. On the other hand they seem to be quite insensible to sound, and whistles and shouts have no effect whatever even on those only a couple of feet away.

Fig. 2.—Head of larva at mouth of burrow.

Probing the holes with a long straw, we find that most of them are 14 inches deep, while an occasional one goes down to 2 feet. In the mild climate of England the larvae burrow only 6 inches into the soil, but in frost-bound Manitoba, Mr. Norman Criddle found the average tunnel to be 66 inches deep with a maximum of 79 inches, a depth bespeaking great energy on the part of both larva and entomologist. The next thing is to secure one of the occupants for examination. There are two ways of catching them. The first, which is possible only in loose soil, is to sit close by a hole with a sharp trowel ready presented, so that when the insect comes to the top, the blade can be suddenly plunged into the earth beneath him, cutting off his retreat. This is a very sporting method, as it calls for long and patient waiting. And it is most exasperating, when, after you have

sat motionless in the hot sun for many minutes, the larva at last comes up, only to drop again in a flash, terrified by the enormous new bulk he caught sight of glowering in his familiar landscape.

The other method of capture is more laborious but more certain. A long straw is inserted in the burrow to mark the course, and then about a foot away a hole is dug with the trowel, going down a little deeper than the bottom of the tunnel. From this a sap is excavated towards the straw, which is carefully uncovered from the top downwards. Near the bottom will be found the squirming, flipping grub we are looking for.

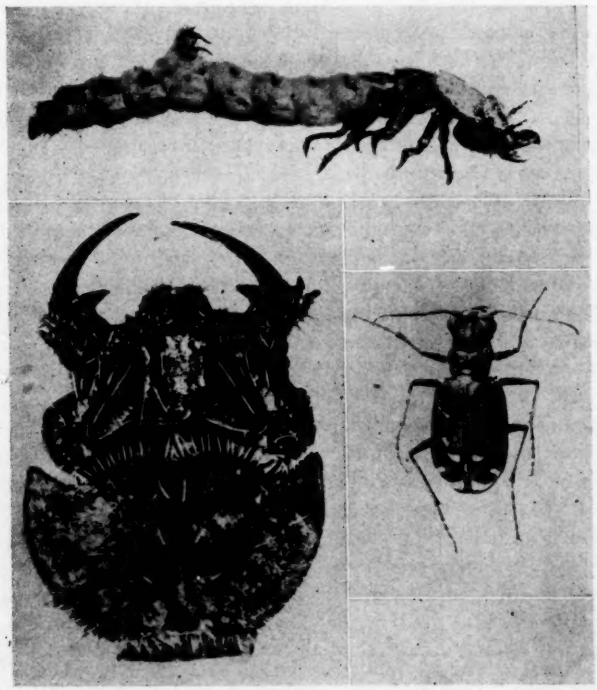

Fig. 3.—Tiger beetle larva, enlarged head of same and adult beetle.

A well-grown specimen is about an inch long with a slim, yellowish-white abdomen and dark-colored thorax and head. It has six thoracic legs, and on its back at the fifth abdominal segment is a curious hump armed with two sharp, curved spines directed forward. This organ is a good example of special development to meet special conditions. When watching at the mouth of its burrow, the creature maintains its position by resting its tail—which is armed with a number of stiff hairs—against one side of the shaft and its hump against the other side with the sharp spines hooked into the wall. In this posture the upper part of the body is crouched down, the flat top of the head coming just level with the surface of the soil. On the approach of its prey, the insect suddenly flings itself part way out of the hole, and seizes the victim with its large jaws.

The curved spines of the dorsal hump, being firmly caught in the earth, prevent it from throwing itself entirely out of the burrow, and no doubt also enable it to resist the pull of any extra large insect it may lay hold on.

When looked at more closely, it is seen that the disc that plugs the mouth of the burrow is not all head. The rear portion of it is a semi-circular plate covering the first dorsal segment of the thorax or pronotum. Situated at the back part of the head, close to the joint between it and the pronotum plate are the insect's four large eyes, two on each side. They are set on the opposite slopes of two little prominences so as to give vision over a complete hemisphere. There are besides two small eyes on what might be called the creature's "cheeks." A large pair of mandibles, sharp-pointed and toothed, are always ready to fasten inexorably on any unwary wanderer.

Torn from their shelter, the grubs are dazed at first. Some of them lie motionless on the sand for half an hour, feigning death. Others, reacting quicker to outrageous fortune, crawl away at once, and soon begin to dig in again. It is noteworthy that the evicted grub never tries to take possession of a ready-made burrow. It seems to realize the kind of welcome it would receive in a brother's tunnel. Specimens brought home for observation purposes were placed in sand-filled jars. If two individuals were put in at the same time, a duel to the death engaged at once. The only way to avoid fatal conflict was to wait until one grub had dug down three or four inches before introducing another. The second arrival would soon begin an excavaction for himself, and when he had disappeared in the sand, another grub could be safely started.

They dig first by loosening the soil with their jaws and scraping it up with their legs. They then push their flat heads under the mass, and reversing their position in the tunnel, raise the earth to the surface on the top of their heads, and jerk the load out of the tunnel, throwing it to a distance of three to six inches from the pit mouth. Although the shaft seems to be a close enough fit for them, the insects are so limber that they can easily bend themselves double and turn around in the closest quarters. Always after a shower of rain, some of the citizens of Tiger Beetle Town found it necessary to dig out soil that had been washed into their burrows, and every minute or so the observer saw a head load of sand flung out. The insect's semi-liquid excrement is also cleaned out in the same manner and thrown well away from the mouth of the burrow.

Nor is their work limited to simple excavating. Where the surface soil is loose they cement the earth around the mouth of the tunnel so as to keep it from crumbling in on them. When necessary they may even continue the shaft above ground by building a wall. A thick, dead mullein leaf, partly embedded in the soil, lay over three of the tunnels in Tiger Beetle Town, and where they came up, the leaf did not quite touch the ground. Now, it is of first importance to the larvae that the mouths of their burrows shall be free of any obstruction. An overlying leaf like this, preventing the approach of prey, would mean death by starvation. They cannot afford to have their lights hidden under either a bushel or a mullein leaf. So these three larvae had built around the mouths of their tunnels little curbs a quarter of an inch high, reaching up to the leaf, which was neatly perforated, thus bringing the tunnel up to the open, game-frequented surface.

It is amusing to drop a tiny white pebble down a shaft and watch results. In a few minutes, up it comes on the tenant's head, and is catapulted out of the hole, and it is not hard to imagine some coarse insect curse. Everything is thrown away as far as possible. It is all very well for that intolerant and churlish nationalist, the ant, with her intense hatred of foreigners, to encumber the approach to her nest with a lot of loose-piled sand. But the tiger beetle is different. He has an unaffected welcome for every visitor, and makes the path to his door as smooth and pleasant as he can.

But with all their deadly preparation and equipment for the capture of prey, it is a mystery to me how they get enough to eat. During a period of six weeks, I watched the inhabitants of Tiger Beetle Town at different times of the day for an aggregate of at least ten solid hours, and in all that time I saw only one very small ant snatched to her doom. On another occasion I noticed on the sand a dragon-fly that seemed to have lost its abdomen. I picked it up to see how the accident might have occurred, and was surprised to find that the abdomen was attached to the insect as usual, but had been pulled down into a tiger-beetle's hole. The dragon-fly's stiff-opened wings had prevented it from being drawn completely into the tunnel, but the larva had evidently held on implacably, and all the dragon-fly's efforts to escape, as shown by the marks of its wings on the sand, had been without avail. However, its steel-blue armor-plate had protected it from serious injury, and it did not seem much damaged when I set it free. These were the only two captures I ever witnessed. The little ant cannot have been more than a light lunch, and the dragon-fly was too tough to eat. But perhaps the larvae have better luck at night. They certainly stay up on the watch all night, as I have ascertained from the dozen individuals I kept in pots of sand at home. No matter what time of the night the light was turned on, there were the heads blocking the holes, and although too small to be seen by the unaided eye, I could picture the steady stare of those immovable black eyes, watching in perpetual hope that something would come along very soon now.

My captives always had excellent appetites for the tiny earth-worms I fed to them. Of course they were instantly scared to the bottom when I came with the food, but they did not stay there very long. Some sense told them that there was a fat worm waiting at the door. The wretched little worm squirmed around aimlessly, as if unable to make up its mind what to do next. But suddenly its mind was made up for it, once and for all, and it was jerked into the hole so swiftly that sight could not follow the procedure. It simply instantaneously disappeared.

None of the larvae I kept at home reached maturity or even pupated. At the end of October they plugged up their tunnels at about the same date that Tiger Beetle Town closed for the season. Digging them up several times during the season to see if there was any change in them—and there was none—caused the death of all but two. Stimulated by the warmth of the house, these opened their tunnels on the fifth day of March, though Tiger Beetle Town began business only on the 7th of May. But they did not remain at the surface, and soon died. The identity of my larvae is therefore in doubt, but as the only tiger beetle imago I have ever found in the vicinity is *Cicindela tranquebarica* Hbst.

(kindly named for me by Mr. Norman Criddle) it seems likely that the larvae belonged to that species.

The life cycle of the tiger beetle lasts from one to three years, according to climate. Prof. V. E. Shelford of the University of Illinois, who has published the best account of the insect's bionomics, says that in the spring the female lays about 50 eggs singly in the sand, and where he studied the insects, a complete generation from egg to egg lasted one year, the adults hibernating in holes in the soil. In Eastern Ontario the life cycle appears to occupy two years, and in Manitoba, Criddle found the period to be three years.

NOTES ON COCCIDAE X. (HEMIPTERA).[1]

BY G. F. FERRIS,
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A REVIEW OF GREEN'S "THE COCCIDAE OF CEYLON."

The appearance of the fifth and final part of "The Coccidae of Ceylon" is a distinct event in the history of the study of the Coccidae, for this work is immeasureably the most admirable treatise dealing with this group that has ever appeared. The first part was issued in 1896 and successive parts have appeared in 1899, 1904, 1909, with the final part in 1922.

The volume composed of these five parts deals with the fauna of a relatively limited area, but it is by no means proportionately limited in its interest to the students of the Coccidae, for many of the included species are practically cosmopolitan. Within its pages there are considered—according to my count—201 species, and in an appendix there are listed 79 more that have been recorded from Ceylon in other publications, a total of 280 for the island. When it is remembered that Ceylon is scarcely 275 miles long and 150 miles wide, these figures become impressive. They are a striking indication of the richness of the tropical scale insect fauna. There are present in this island considerably more than one tenth of all the species of Coccidae that are known!

For the book in general there can be nothing but praise. It represents a tremendous amount of labor, most faithfully performed. But there are a few points concerning which there is some ground for a difference of opinion, and as the volume is likely to stand for a long time as an authoritative source of information, it is perhaps worth while to discuss these. This is also a favorable opportunity for a critique of some of our prevalent methods in the study of the Coccidae. In the course of this discussion I shall consider merely the fifth part of the volume for the long periods that have elapsed since the appearance of the other parts have given ample time for the emendation of these, and in an appendix to Part V, many of these points are considered by the author himself. Furthermore, it is only fairness to say that it is only the long time that Part V has been in press that has prevented the author from making some changes in its content.

The fifth part deals with the subfamilies Eriococcinae, Dactylopiinae, Tachardiinae, Ortheziinae, Margarodinae and Monophlebinae.

The sub-family Eriococcinae is interpreted by Green to include *Eriococcus, Gossyparia, Fonscolombia, Kermes, Pseudopulvinaria* and *Rhizococcus.* So far

1—Continued from Canadian Entomologist, Vol. LIV. page 161.

we are in complete agreement, but with the definition of the subfamily and the exclusion from it of certain other genera, I cannot agree. Green's conception of the subfamily seems to be based chiefly upon the presence—usually—of pronounced anal lobes and on the character of the antennae and of the first stage. Such a conception is not adequate, for as Green points out, the anal lobes are not present in certain forms that appear to belong to this group. They are not, however, lacking in *Kermes*, as Green believes, for in several species that I have examined there are well developed and heavily chitinized anal lobes.

The essential characters of the subfamily, as I conceive it, are in part the negative ones of the absence of peculiar structures such as the abdominal spiracles, dorsal ostioles, anal operculum and the like, combined with the positive ones of type of tubular ducts, character of antennae and of the first stage. Interpreted in this fashion, the subfamily easily and naturally includes all the above genera as well as *Cryptococcus* and *Gymnococcus*, which are included by Green in the Dactylopiinae.

Green himself recognizes the difficulties with his subfamily Dactylopiinae, saying that "This rather unwieldy group is at present made to include a large number of genera for which it is difficult to assign any single common character." The reason for this difficulty is simply that the subfamily constituted of these genera is highly unnatural. The majority of the genera form a very compact and easily recognizable group that is sharply limited by the presence of dorsal ostioles. This group will stand as the subfamily Pseudococcinae. The genus *Dactylopius* itself is of somewhat doubtful relationships, but would go better into the Eriococcinae (or Dactylopiinae as it would then be called) and with it should go *Cryptococcus* and *Gymnococcus*. *Halimococcus, Capulinia* and *Kuwanina* are of doubtful affinities, but are at least not Pseudococcine. *Apiococcus* remains to be elucidated.

The genus *Geococcus* is interpreted as intermediate between the Eriococcine and Pseudococcine groups. I am unable to see this, for, although it is in some respects a peculiar form, it is in its essentials strictly Pseudococcine. It may be noted that in the case of this and most of the other Pseudococcine genera dealt with by Green the dorsal ostioles are not mentioned. Nevertheless, they are present in all of them, as I can testify from an examination of specimens that have been received through the kindness of Mr. Green.

The genus *Erioides* is structurally very close to the American genus *Porococcus*. In fact, I see no very adequate morphological basis for the separation of the two. The difference in the secretions, however, is quite striking, *Porococcus* having a hard test while the test in *Erioides* is felted.

Some of the species referred by Green to the genus *Phenacoccus* seem scarcely congeneric with the type. *P. insolitus* approaches more nearly *Synacanthococcus* while *iceryoides, ornatus* and *mangiferae* come nearer to *Puto*.

Lachnodius humboldtiae is certainly not congeneric with the type of *Lachnodius*. The latter has been re-described by Morrison and Morrison,[2] and there

2—Morrison and Morrison, A Redescription of the Type Species of the Genera of Coccidae Based on Species Originally Described by Maskell. Proc. U. S. Nat. Mus. 60: 44-8; f. 14. (1922)

remains no doubt as to its character. I agree with these authors that it is not Pseudococcine. *L. humboldtiae* on the other hand is certainly Pseudococcine, but its proper disposition must wait upon a more complete study of the group.

Green accepts the three "subfamilies" Ortheziinae, Margarodinae and Monophlebinae. I wish again to emphasize the viewpoint that these divisions are not satisfactory and that these groups are more closely related than such an arrangement indicates.

In his discussion of the Monophlebinae, Green lumps under *Monophlebus* the genera *Drosicha, Llaveia, Tessarobelus, Ortonia, Gueriniella,* (*Guerinia*) and *Monophlebulus*. In this I can not at all follow him. We do not know what the genus *Monophlebus* really is, for the type species was described only from the male and under such circumstances it would seem reasonable to restrict it simply to this species, and to use such generic names as we do know the proper application of for the other species. Furthermore, these genera are certainly not all the same. *Ortonia* is a synonym of *Llaveia* but *Llaveia* is very readily and very justifiably separable from the others named; nor is it at all difficult and certainly it is not unjustifiable to separate *Drosicha* and *Gueriniella*. As to *Monophlebulus* and *Tessarobelus* there may be more doubt, although they too are probably distinct. I shall discuss some of these genera further in another paper in these notes, and shall point out the actual structural differences between them.

So much for these specific criticisms, which are intended not so much as criticisms but as bases for discussion. There remain a few other points that are perhaps worthy of consideration and the criticisms of which are not directed specifically at "The Coccidae of Ceylon" as much as at our work on the Coccidae in general.

One of these has to do with the matter of keys. A key is, in the opinion of the present writer, merely a means of arriving at an identification. On this basis it should be as simple and as carefully constructed as possible. Yet it has been a common practice among students of the Coccidae to base keys upon both sexes and all stages of the species or genera. Thus, Green's keys to the Margarodinae and Monophlebinae are based in part upon the males and first stage, which are not always procurable. Such a practice defeats the purpose of a key, and is especially unfortunate, as it is certainly possible to construct keys that do not use such characters.

Again, there is a need for more accurate study of the dermal structures involved in the production of the secretionary covering—the ducts and pores. It is but recently that any special attention has been paid to these, but I venture to assert that they will become more and more important. The most careful and accurate figures of these should be presented.

Another general criticism has to do with the matter of figures. It has been a very common practice to represent the insect as it is actually seen on the slide, that is, with the structures of both dorsal and ventral sides showing through as if they are on the same side of the body. This is an entirely illogical practice that should be abandoned. The divided drawings that are now being very extensively used have the merit of being clear and logical, even if at first glance they may not appear quite as pleasing to the eye.

THE NORTH AMERICAN SPECIES OF THE GENUS ACRONEURIA (ORDER PLECOPTERA).

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Having nearly completed a monograph of the North American species of the Order Plecoptera, the publication of which will probably be delayed for some time, we propose to publish the results of our studies that are of most immediate importance to other workers on the group in a series of short papers, the first of which is this one on the species of *Acroneuria*. We shall include in these papers only diagnostic characters (mostly in keys to the species), notes on synonymy, and descriptions of new forms, leaving detailed descriptions of known species and illustrations to await the publication of the monograph.

The genus *Acroneuria* includes a number of large species in which the prolonged and upturned 9th ventral segment in the male bears a prominent mid-ventral chitinized percussion disc or hammer, and the genital hooks are developed from upcurving angles of the subanal plates. The tergum of the 10th abdominal segment is undivided. The venation of the wings is copious; the subcosta is long; the fusion of radial sector and median vein in the disc of the hind wing is moderate, the anal area of the hind wing is broad, the branches of the 2nd and 5th anal veins being numerous. In *A. abnormis* Newman, there are numerous crossveins in the wing apex beyond the cord, but in the series of species these gradually disappear, and in some are quite lacking.

Under the genus *Acroneuria* we recognize the following three subgenera: 1. *A.* (*Acroneuria*) Pictet; 2. *A.* (*Eccopturà*) Klapalek; 3. *A.* (*Doroneuria*) subgen. nov.

1. *A.* (*Acroneuria*) Pictet. 1841, Perlides, p. 144. Male, ninth ventral segment prolonged and bearing a round or transversely oval hammer; genital hooks either flat or cylindrical; female, eighth ventral segment either unmodified or produced into subgenital plate.
   Subgenotype. A. (*Acroneuria*) *arenosa* Pictet.

2. *A.* (*Eccoptura*) Klapalek, 1921, Bull. de la Soc. Ent. de Belgique 61:60 Color wholly yellow; no cross veins in the tip of wing beyond the cord; ninth ventral segment of male prolonged and bearing a longitudinally oval hammer; genital hooks cylindrical, pointed and bearing at the base a bunch of hairs; female, eighth ventral segment produced into a bilobed subgenital plate.
   Subgenotype. A. (*Eccoptura*) *xanthenes* Newman.

3. *A.* (*Doroneuria*) subgen. nov. No cross veins in the tip of wing beyond the cord; ninth ventral segment of male prolonged and bearing a longitudinally rectangular hammer; female, eighth ventral segment not produced into a subgenital plate.
   Subgenotype. A. (*Doroneuria*) *theodora* sp. nov.

Among the numerous species described by the older authors, *A. abnormis* appears to be the only one that has been correctly identified by all those who have discussed the genus. The others we found in a confusion that seemed at first to be inextricable. But a restudy of the types and topotypes in American collections,

a comparison of notes made from types in European collections by helpfully minded colleagues, and adequate collections from typical localities, have enabled us to identify all the species of the older authors with some assurance.

The species we recognize as valid may be separated as follows:

ARTIFICIAL KEY TO THE SPECIES OF ACRONEURIA.

1. Fore wings suddenly widened beyond origin of Rs. Color wholly yellow. Female subgenital plate bilobed, the median notch rectangular. Male genital hooks cylindrical, bearing at the base a bunch of hairs; hammer small, longitudinally oval; segments 9 and 10 above with short spines. ..*xanthenes*

   Fore wings gradually widened to stigma. Color not wholly yellow.....2

2. Second anal vein of hind wing many (about 12) branched, the branches variously anastomosing. Female subgenital plate produced over half of segment 9, the hind margin evenly rounded. Male genital hooks cylindrical, sharp; hammer small, transversely oval; segments 8, 9 and 10 above with short spines.....*arenosa*

   Second anal vein of hind wing 3-6 branched 3

3. Cross veins numerous over the entire area in fore wing beyond the cord; usually a pair of triangular dark spots on head behind the ocelli pointing inward. Female subgenital plate slightly produced, hind margin even. Male genital hooks flat, triangular, sharp; hammer transversely oval; segments 9 and 10 above with short spines.....*abnormis*

   Area beyond the cord in fore wing not entirely filled in with cross veins; no triangular spots on head behind ocelli.....4

4. Head with a blackish spot covering the ocellar triangle; Eastern species...5

   Head usually pale or concolorous above, including the ocellar triangle; (*pacifica* sometimes with black over the ocellar triangle).....8

5. With very few (1-4) cross veins in the area beyond the cord; female subgenital plate evenly rounded or somewhat excavated. Male genital hooks flattened, triangular, sharp; hammer small, transversely oval, segments 9 and 10 above with short spines.....6

   With a larger number of cross veins in the area beyond the cord; female subgenital plate not evenly rounded; male genital hooks long, cylindrical; segments 9 and 10 above with short spines.....7

6. Black spot over ocellar triangle rounded behind; female subgenital plate produced, hind margin either evenly rounded, truncate in the middle, or somewhat excavated.....*lycorias*

   Black spot over ocellar triangle angulate behind; female subgenital plate produced, hind margin angulately emarginate in the middle.....*carolinensis*

7. Subgenital plate of female produced somewhat and bearing two flap-like lobes. These lobes are often found to be laid back over the plate so that the plate appears to be more or less evenly rounded.....*internata*

   Subgenital plate of female produced over about half the length of segment 9, and bearing in the middle a short, declivitous, narrowed portion (♂ unknown) .....*trijuncta*

8. Head and thorax wholly blackish; no extra crossveins beyond the cord. Female subgenital plate not produced, hind margin entire. Male genital hooks

short cylindrical; hammer large, longitudinally rectangular, surface ridged; no spines above on segments 9 and 10.....*theodora*

Head and thorax pale or obscure, never wholly blackish.....9

9. Usually with no crossveins beyond the cord; female subgenital plate not produced, western species.....10

With crossveins beyond the cord; female subgenital plate produced and variously modified.....11

10. Vein Sc weak and indefinite at its tip. Female subgenital plate cut straight across apex. Male genital hooks flat, triangular; hammer large, transversely oval; segments 9 and 10 above with short spines. Expanse of wings 50-70 mm.....*depressa*

Vein Sc stronger and definite at its tips. Female subgenital plate not produced but somewhat emarginate in middle, 9th ventral segment of female with a rounded spot each side. Male genital hooks cylindrical; hammer longitudinally rectangular; no spines above on segments 9 and 10. Expanse of wings 40-55 mm. .....*californica*

11. Median longitudinal depressed area between the rugosities of the pronotum wide (about one sixth of width of pronotum). Male genital hooks flat, short and very broadly triangular, as wide as long; hammer transversely oval; female subgenital plate produced, and evenly rounded. Western species 12

Median longitudinal area of pronotum narrow (about one tenth of width of pronotum); male genital hooks not as wide as long; female subgenital plate variously modified. Eastern species.....13

12 Size large. Expanse of wings 30-50 mm. Female subgenital plate produced over half of segment 9, the hind margin slightly angulate and usually bearing at the apex a squarish, shiny spot.....*pacifica*

Size smaller. Expanse of wings 18-30 mm. Female subgenital plate produced over two thirds of segment 9, the hind margin evenly rounded and not bearing at the apex a shiny spot.....*pumila*

13. Female subgenital plate much produced, either bilobed or bearing a declivitous projection. Male genital hooks cylindrical, segments 9 and 10 above with short spines.....14

Female subgenital plate not much produced, hind margin more or less evenly rounded. Male genital hooks flattened, triangular.....15

14. Female subgenital plate narrow at base and at the apex two-lobed. Male genital hooks cylindrical, slender and usually outcurved, hammer small, almost circular.....*arida*

Female subgenital plate with a declivitous projection whose hind margin is entire. Male genital hooks more broadly cylindrical and usually straight, hammer larger, transversely oval.....*evoluta*

15. Female subgenital plate somewhat produced, evenly rounded and bearing before the apex a transverse narrow tubercle. Male genital hooks flat, broadly triangular, hammer transversely oval, segments 9 and 10 above without short spines.....*ruralis*

Female subgenital plate somewhat produced, the hind margin slightly angulate, no tubercle before the apex. Male genital hooks flat, narrowly trian-

gular, hammer transversely oval, segments 9 and 10 above with short spines ..... *pennsylvanica*

The following is a list of the North American Species of Acroneuria which are known to us, arranged in the order in which they were described, with synonyms.

1. *Acroneuria xanthenes* Newman, 1838. Ent. Mag. 5:178.

brevicauda Klapalek, 1909. Bull. Internat. Acad. Sci. Boheme, p. 12.

This is the only species of this genus which is wholly pale yellow. It ranges over the Southeastern States. Klapalek's description of *brevicauda* has led us to believe that it is a synonym of *xanthenes*. He gives no figure, and does not include the species in his key to the genus, immediately preceding.

Klapalek's treatment of *xanthenes* both in the paper above cited and in Bull. de la Soc. Ent. de Belgique 61:60, 1921, posthumously published by Lestage, evidences too great haste to describe. In the latter paper he makes *xanthenes* holotype of a new genus *Eccoptura,* based mainly on secondary sexual characters of the male. These are for the most part stated incorrectly.

2. *Acroneuria abnormis* Newman, 1838. Ent. Mag. 5:177.

This is about the only species of this genus described by older authors that has been correctly identified by all later workers on this group. The manuscript name *sonans* (Barnston) Newport is a synonym of *abnormis*. Generally distributed east of the Rocky Mountains.

3. *Acroneuria lycorias* Newman, 1839. Ann. Mag. Nat. Hist. 3:85.

A. navalis Provancher, 1883. Pet. Faun. Can. Neurop. p. 73.
A. riparia Provancher, 1883. Pet. Faun. Can. Neurop. p. 74.
A. excavata Banks, 1908. Trans. Am. Ent. Soc. 34: 256.

Ranges over eastern North America and extends as far as Virginia. There is considerable variation in the subgenital plate of the female. The hind margin is either evenly rounded, truncate at the apex or slightly emarginate. Through the kindness of Canon Huard Provancher's types in the Provincial Museum at Quebec were studied in January 1922 by the senior author, and Banks' and Hagen's types were studied in February, 1922 by the junior author.

4. *Acroneuria arenosa* Pictet, 1841. Perlides, p. 178.

This is the type species of the genus. It ranges over the Eastern States.

A comparison of a large series of topotypes from Pennsylvania with the description and figures of Pictet has enabled us to identify this species beyond doubt. The large number of branches of the second anal vein of the hind wing sets off this species from all others in the genus. Pictet's figure (fig. 2, plate X), though none too well drawn, shows this character.

5. *Acroneuria pennsylvanica* Rambur, 1842. Neurop. p. 456.

Klapalek (Bull. Internat. Acad. Sci. Boheme, p. 8, 1909) has seen the type and rescued this species from syonymy. His figure and description, together with a series of specimens from the type locality, shows that *pennsylvanica* is distinct from *abnormis*. Eastern States.

6. *Acroneuria internata* Walker, 1852. Brit. Mus. Cat. Neurop. p. 152.

7. *Acroneuria trijuncta* Walker, 1852. Brit. Mus. Cat. Neurop. p. 153.

Both these species have long reposed in our lists as synonyms of *A. abnormis*; but Dr. Nathan Banks has studied the types, and the notes and the sketches of them that he has kindly placed at our disposal show that both of them must

be restored. A careful reading of Walker's description will show disagreement with *A. abnormis;* and the secondary sexual characters which Walker did not describe are very different. Though both are eastern species of more than local distribution, neither has been redescribed, and no synonyms have resulted from their long suppression.

8. *Acroneuria arida* Hagen, 1861. Syn. Neur, N. A. p. 18.
valida Banks, 1905. Trans. Am. Ent. Soc. 32: 4.

A study of the type shows this to be a distinct species and not a synonym of *arenosa* as Hagen suggested. Eastern and Southern States.

9. *Acroneuria ruralis* Hagen, 1861. Syn. Neur. N. A. 18.
rupinsulensis Walsh, 1862. Proc. Acad. Nat. Sci. Phil p. 363.
quebecensis Provancher, 1883. Pet. Faun. Can. Neurop, p. 72.
attenuata Banks, 1905. Psyche, 12: 55.

Topotypes of *A rupinsulensis* Walsh from Rock Island, Ill., agreeing exactly with Walsh's very detailed original description were identified by the senior author as of this species, and so indicated in Bull. U. S. Bur. of Fisheries. 36: 274, 1920. Since then the types of Provancher and Banks and the cotypes? of Walsh in the Hagen collection of the Museum of Comparative Zoology, at Cambridge, Mass., have been studied by us, as well as a large number of specimens from many localities. The transverse narrow tubercle before the apex in the female subgenital plate and the absence of spinules on the dorsal abdominal segments in the male are characters which distinguish this species. Of wide distribution East of the Rocky Mountains.

10. *Acroneuria pacifica* Banks, 1900. Trans. Am. Ent. Soc. 26:242.
nigrita Banks, 1904. Trans. Am. Ent. Soc. 30: 98.

A comparison of the types of *pacifica* and *nigrita* proves these to be identical. Both female types have the subgenital plate evenly rounded, with a shiny squarish spot at the apex. Western States.

11 *Acroneuria californica* Banks, 1905. Inverteb. Pacifica 1:87.
? *concolor* Banks, 1908. Trans. Am. Ent. Soc. 34: 255.

The type of *californica* is a female and the type of *concolor* is a male.

They agree in general characteristics and apparently belong together. California.

12. *Acroneuria carolinensis* Banks, 1905. Bull. Am. Mus. Nat. Hist. 30:215.

This species is very similar to *lycorias* and may be only a variety. The black spot over the ocellar triangle is sharply angulate behind, while in *lycorias* it is evenly rounded. Southeastern States.

13 *Acroneuria pumila* Banks, 1906. Can. Ent. 38:335.

Very similar to *pacifica* but much smaller. Western States.

14. *Acroneuria evoluta* Klapalek, 1909. Bull. Internat. Acad. Sci. Boheme. p. 12.

There is considerable variation in the declivitous extension of the subgenital plate of the female, but in general it may be said to have an evenly rounded or slightly truncate hind margin. Central States and Eastward.

15. **Acroneuria depressa** sp. nov.

Length to tip of wings, male 29-32 mm.; female 32-40 mm. Expanse, male 48-50 mm.; female 56-70 mm.

General color light brown. Head wider than prothorax, reddish brown, darker on clypeus and somewhat darker over the ocellar triangle. Ocelli large, with black on the inside; hind ocelli a little closer to each other than to the eyes.

Prothorax wider than long, not narrowed behind, angles rather sharp, rugosities not very strong. Legs yellowish; femora with a black transverse band just before the tip. Wings uniformly subhyaline; veins light brown; no crossveins in the outer field beyond the cord. Tails light brown, thickly clothed with short hairs. The male ninth ventral segment bears a large, transverse, oval smooth hammer, genital hooks flattened, triangular, sharply pointed; segments 9 and 10 above each with many short spines. Female eighth ventral segment unmodified.

Holotype. Female: Yakima R., W. T. Lone Tree. June 30, '82, S. Henshaw.

Allotype. Male and 7 paratypes (5 females and 2 males) all from same locality.

The holotype, allotype and some of the paratypes are in the Entomological Collection of the Museum of Comparative Zoology, Cambridge, Mass., and the other paratypes are in the Entomological Collection, Cornell University, Ithaca, N. Y.

16. **Acroneuria theodora** sp. nov.

Length to tip of wings, male 29-32 mm.; female 32-40 mm. Expanse, male 48-50 mm.; female 56-70 mm.

General color blackish with smoky wings. Head a little wider than prothorax; black over the ocellar triangle and extending laterally to the base of antennae; occiput and area in front of the frontal M-ridge dark brown; frontal ridge and lateral tubercles yellowish; ocelli form an equilateral triangle; hind ocelli closer to each other than to the eyes. Antennae blackish at base, brown towards the tip; prothorax uniformly blackish, wider than long, somewhat narrowed behind; front angles sharp, hind angles rounded; rugosities rather strong. Wings pale yellow at base, beyond uniformly smoky; veins blackish; no crossveins in the outer field beyond the cord. Basal half of abdomen yellowish above, beyond blackish. Tails brown, thickly clothed with short hairs.

Male brachypterous; ninth ventral segment bears a large longitudinally rectangular hammer whose surface is covered with rearward curving ridges; genital hooks cylindrical, short and sharp. Female eighth ventral segment unmodified.

Holotype, female, Yellowstone National Park.

Allotype, male, and 3 females paratypes from the same locality, in the Entomological Collection at Cornell University.

Another female paratype from Big. Hn. Mts., Wyoming, July 18, '96, R. P. Currie, is in the National Museum, Washington, D. C.

VALID NORTH AMERICAN SPECIES OF ACRONEURIA GROUPED ACCORDING TO RELATIONSHIPS.

1. *A.* (*Acroneuria*) *arenosa* Pictet.
2. *A.* (*Acroneuria*) *abnormis* Newman.
3. *A.* (*Acroneuria*) *ruralis* Hagen.
4. *A.* (*Acroneuria*) *pennsylvanica* Rambur.
5. *A.* (*Acroneuria*) *trijuncta* Walker.
6. *A.* (*Acroneuria*) *internata* Walker.
7. *A.* (*Acroneuria*) *arida* Hagen.
8. *A.* (*Acroneuria*) *evoluta* Klapalek.
9. *A.* (*Acroneuria*) *pacifica* Banks.

10. *A.* (*Acroneuria*) *pumila* Banks.
11. *A.* (*Acroneuria*) *lycorias* Newman.
12. *A.* (*Acroneuria*)*carolinensis* Banks.
13. *A.* (*Acroneuria*) *depressa* sp. nov.
14. *A.* (*Eccoptura*) *xanthenes* Newman.
15. *A.* (*Doroneuria*)*theodora* sp. nov.
16. *A.* (*Doroneuria*) *californica* Banks.

NOTES ON CANADIAN DRAGONFLIES FOR THE SEASON 1922.

BY J. MCDUNNOUGH,

Entomological Branch, Department of Agriculture, Ottawa.

In an effort to build up the Canadian National Collection of Odonata, considerable attention was paid to this group by me and my assistants during the collecting season of 1922. The long spell of fine weather in May and the first half of June was particularly favourable for our work in the vicinity of Ottawa, and dragonflies were found to be much more abundant than usual. Weekly excursions were made to the Mer Bleue, that famous peat bog twelve miles east of Ottawa, the general character of which has already been the subject of an article by Mr. Arthur Gibson (32nd Rep. Ent. Soc. Ont. 1901, p. 110). Visits were also made to some of the smaller lakes on both the Ontario and Quebec sides of the Ottawa River, to suitable marshy spots on the Rideau river, and to some of the numerous brooks in the Gatineau hills situated about nine to twelve miles north of town.

The species mentioned in the following notes constitute in the main new records for the Ottawa district, the majority not being listed in Dr. E. M. Walker's paper (Ottawa Naturalist XXII, 16); the total number of species of this order occurring in the vicinity is now sixty-five.

ZYGOPTERA

Lestes vigilax Hagen. Found quite abundantly in a marshy inlet of the Rideau river by F. P. Ide during the latter half of June and early July.

Lestes inaequalis Walsh. Taken along with the preceding species but apparently quite rare. Only two ♂'s (June 19) and one ♀ (July 21) were captured.

Enallagma antennatum Say. Three ♂'s and one ♀ of this striking species were taken by F. Ide (June 19) in the same spot on the Rideau river as the *Lestes* species.

Engallagma signatum Hagen. Found in numbers flying well out from shore over the lily pads on the Rideau river about 5 miles south of Ottawa by F. Ide (Aug. 6).

ANISOPTERA

Gomphus spicatus Hagen. A long series of this species, including two ♀'s, was taken at MacKay's Lake, Rockcliffe (June 13, 15). It was first recorded by me from this region in 1920 (Can. Ent. LIII, 14).

Gomphus descriptus Banks. A single ♀ was captured by my assistant, Mr. A. Richardson, at Meach Brook, Gatineau Hills, Que., on June 27. We had

hoped to secure a good series, but it was apparently too late in the month for the species.

Gomphus brevis Hagen. Besides the localities given by Dr. Walker, I have taken the species sparingly at McKay's Lake, Rockcliffe.

Gomphus cornutus Tough. Walker records this from the Mer Bleue, but as a matter of fact the species does not fly over the bog, but along the shores of a small, clay-banked creek, called Castor River, that flows through the village of Carlsbad (Eastman's) Springs, about a quarter of a mile from the Mer Bleue. Here we found it plentifully on June 7 and Mr. Richardson also took a single specimen on June 27 at Fairy Lake, Hull, Que.

Ophiogomphus anomalus Harv. A single ♂ of this species was captured by Mr. Richardson near Meach Brook, Que. (June 20) and one ♀ was taken by myself at Wakefield on the Gatineau river (Aug. 7). The determination was kindly made for me by Mr. E. B. Williamson, Bluffton, Ind.; the species is new to Canada.

Dromogomphus spinosus Selys. One specimen was taken, June 5, by F. P. Ide, in the vicinity of the Rideau river, Ottawa South.

Cordulegaster diastatops Selys. One ♂ was taken, June 27, by Mr. Richardson along Meach Brook, Que. It was recorded by Dr. Walker without mention of locality.

Aeshna verticalis Hagen. A single ♂ was taken at the Mer Bleue by F. P. Ide (July 24); the species is rare in the Ottawa district, the only other specimen in the collection from this region having been taken at Queen's Park, Aylmer, Que., by C. B. Hutchings.

Macromia illinoiensis Walsh. Mr. Richardson found this handsome species quite common on Meach Brook, June 27.

Epicordulia princeps Hagen. Recorded by Walker from a fragmentary specimen, no locality; it was not uncommon at Fairy Lake, Hull, Que. (June 29) and was taken on the Rideau river (Black Rapids) as late as August 12.

Tetragoneuria canis McLachlan. This species was quite common both at the Mer Bleue and along Castor River at Eastman's Springs. It is one of the first species on the wing (May 23), and although generally rare was this year much commoner than either *cynosura* or *spinigera*, the latter of which also is found at the Mer Bleue.

Williamsonia linteri Hagen.* The species has long been known to occur in this region on the strength of two specimens taken by C. H. Young at the Mer Bleue in 1908. Mr. A. Richardson and myself were fortunate enough to secure eight specimens (4 ♂, 4 ♀) on May 23; they were flying among the small spruce trees situated close to a sphagnum bog, and as several were tenerals, it is probable that the nymphs were breeding in the near-by pools. The mature adults are difficult to see, as they have the habit of sitting with expanded wings on the spruce trunks, darting out at intervals to capture a mosquito. By the end of May the species had disappeared.

Somatochlora franklini Selys. We first met with this species at the Mer

*—Since writing the above Mr. Williamson to whom our material was submitted informs me that the species is not the true *lintneri* but a new species of *Williamsonia* which he purposes to describe shortly.

Bleue on May 23 when several teneral specimens were taken flying along with *W. lintneri.* Two weeks later adults were fairly common about 11 a.m., flying close to the ground over bare areas containing scattered dead dwarf larches, on the branches of which they would occasionally alight.

Somatochlora kennedyi Walker. Two ♂ specimens were taken (June 7) along with the preceding species, from which they can with difficulty be distinguished on the wing.

Somatochlora walshi Scudder. Two ♂'s and one ♀ were captured on July 24 by Messrs. Richardson and Ide at the Mer Bleue around the same sphagnum bog where *W. lintneri* occurred earlier in the season.

Erythemis simplicicollis Say. This species, recorded by Walker from "Ottawa," has been found sparingly at Fairy Lake, Hull, Que. I have not met with it on the Ontario side of the Ottawa River.

From June 15th to June 24th I collected dragonflies in Algonquin Park, Ont.; with headquarters at the Highland Inn on Cache Lake, the main collecting was done in the marshy inlets of this lake, along the railway track west of the Inn, where there is a considerable area of swampy ground, and at the headwaters of the Madawaska river, which crosses the track about one and a half miles west of the Inn and descends to a lower level by a series of rapids and pools. Dragonflies were very plentiful on favourable days, although the black flies at times made collecting almost impossible; besides most of the species mentioned by Dr. Walker in his Algonquin Park list (36th Rep. Ent. Soc. Ont. p. 64) the following species, which constitute new records for the region, were captured.

Coenagrion resolutum Hagen. Not rare in reedy spots.

Chromagrion conditum Hagen. Very plentiful among the reeds on the Madawaska River and marshy spots along the railroad tracks.

Cordulegaster diastatops Selys. Common along a small trickle of water bordering the railroad track about a mile west of the hotel; the ♀'s were observed depositing ova. It was also observed in a small upland bog in the woods back of the Highland Inn.

Cordulegaster maculatus Selys. Found flying with *Macromia illinoiensis* over the pools and rapids of the Madawaska river.

Gomphus spicatus Hagen. One ♂ and one ♀ were captured on the Madawaska river.

Gomphus descriptus Banks. The commonest Gomphus on the Madawaska river.

Dromogomphus spinosus Selys. One ♂ and one ♀ were taken in the woods back of the Highland Inn.

Tetragoneuria canis McLachlan. Moderately common along the railroad track along with *L. proxima.*

Dorocordulia libera Selys. Five ♂'s were taken in a marshy corner of Cache Lake, east of the hotel.

Leucorrhinia hudsonica Selys. Common on roads through the woods in the neighborhood of swamps.

Leucorrhinia proxima Calvert. In countless numbers in the swamps along the track just west of the hotel.

THE NORTH AMERICAN SPECIES OF LABOPS (HETEROPTERA—MIRIDAE).[1]

BY HARRY H. KNIGHT,
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KEY TO THE SPECIES OF LABOPS

1. Hairs on hind tibiae shorter than the true spines; hind tibiae uniformly black 2
   Hairs on hind tibiae prominent, in length exceeding the true spines, length of hairs also greater than diameter of tibia; tibiae largely pale or yellowish ..... *hirtus* n. sp.
2. Juga of male strongly inflated, thus concealing base of tylus when viewed from lateral aspect, frons scarcely convex, median line pale; female with frons more prominent but vertex sloping sharply downward in front, median line of frons pale; larger, length 3.5—6 mm. ..... *hesperius* Uhl.
   Juga of male moderately prominent, base of tylus visible as seen from lateral aspect; both sexes with frons strongly convex, meeting the nearly horizontal vertex well forward of the eyes; small, length 3—3.4 mm. .... *tumidifrons,* n. sp.

Labops hesperius Uhler.

Hayden's Surv. Terr., Rept. for 1871, p. 416, (1872).

This species is best distinguished in the original description by the following: "Legs black; the apex of the femora and base and apex of the coxae orange yellow. Scutellum and hemelytra with grayish, prostrate pubescence;.... ....Abdomen densely sericeous pubescent, ... the posterior segments more or less hairy." A study of considerable material shows that the type of pubescence, as well as coloration of the legs, are constant and distinctive characters.

Our eastern form of *Labops* has usually been determined as *hesperius* Uhler, and although it occurs in Colorado and Montana, the original description clearly indicates which one of the two species the author had before him when drawing up the description.

Specimens examined: MONTANA— ♀ June 30, 1900, Bozeman. ♂ June 26, 1903, Forsyth. ♀ June 27, 1913, Monida. ♂ ♀ June 19, 1921, Willow Creek, Gallatin County (Wm. C. Cook). SOUTH DAKOTA— ♂ June 1, 1921, Capa (H. C. Severin). WYOMING—2 ♂ 2 ♀ July 20—25, 1920, Yellowstone National Park (A. A. Nichol). ALBERTA—18 ♂ ♀ July 1—3, 1915, Maligne Lake (E. L. Diven).

Labops hirtus new species.

Male. *Brachypterous form,* length 4.3 mm., width 2 mm. *Head*: width across eyes 1.7 mm., vertex 1.03 mm.; clothed with prominent, erect, pale yellowish hairs, and intermixed with a few silvery scale-like hairs on vertex and front; juga moderately prominent but not obscuring the base of tylus when viewed from lateral aspect; black, shining, with juga, genae, spot beneath eye, mark on median line of front, spot each side of vertex and extending mesad along base,

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pale to yellowish. *Rostrum*, length 1.5 mm., extending upon middle of hind coxae, black.

Antennae: segment I, length .63 mm.; II, 1.73 mm.; III, .76 mm.; IV .81 mm.; black.

Pronotum: width at base 1.45 mm., anterior angles 1.09 mm.; clothed with prominent, erect, pale yellowish hairs and intermixed with closely appressed scale-like pubescence; black, lower margins of pleura pale. *Scutellum* black, triangular, mesoscutum moderately exposed; clothed like the pronotum. *Sternum* and pleura black, clothed with prominent erect pilose hairs; posterior half of ostiolar peritreme and slender margin bordering intermediate coxae, pale.

Hemelytra: embolar margin arcuate; cuneal fracture present but cuneus poorly developed; membrane absent in brachypterous form; black, embolium and outer margin of corium, and extending beyond the cuneal fracture, pale yellowish; thickly clothed with erect, stiff yellowish hairs, and intermixed with closely appressed, silvery, scale-like hairs.

Legs: coxae black, apices and a spot near base yellowish; femora black, apices yellowish, more or less yellowish at middle but with black color continuous on dorsal surface, the yellow on hind pair forming a line on anterior and on the posterior aspect; tibae yellowish, with base and apex blackish, front pair more nearly black; tarsi black.

Venter: black, shining, clothed with prominent, erect yellowish hairs, and with a few scale-like hairs near base.

Macropterous form, length 5.7 mm., width 2.3 mm.; similar to the brachypterous form but with membrane fully developed and fuscous to black in color.

Female. *Brachypterous form*, length 4.6 mm., width 2.3 mm.; more robust but very similar to the male in structure and coloration.

Macropterous form, length 5.7 mm., width 2.6 mm.; similar to the brachypterous form but with membrane fully developed.

Holotype: ♂ July 11, 1917, Cranberry Lake, New York (C. J. Drake); author's collection. *Allotype*: same data as the type. *Paratypes*: MAINE—1 ♂ 1 ♀, July 4, 1915, Paris (C. A. Frost). MONTANA—♂, July 1, 1901, Bozeman, alt. 4800 ft. (E. J. Moore). NEW HAMPSHIRE—1 ♂ 1 ♀, June, 1908, Claremont. ♂, July 6, 1914, Mt. Washington (C. A. Frost). NEW YORK—2 ♂, July 2, ♂, July 3, 2 ♂, July 6, ♂, July 11, ♂, July 22, Cranberry Lake (C. J. Drake). 2 ♀, June 21, 1915, Wilmington (Wm. T. Davis). VERMONT—♂ June 23, 1913, Stowe (G. P. Englehardt). ♀ July 10, 1913, Stratton (P. W. Whitney). WYOMING—2 ♂ 7 ♀ (brachyp.), 5 ♂ 4 ♀ (macropt.), July 20—25, 1920, Yellowstone National Park (A. A. Nichol). CANADA: ALBERTA—♀ June 18, 1919, Edmonton (F. S. Carr). BRITISH COLUMBIA—♂ 2 ♀, July 28, 1920, Chilcotin (E. R. Buckell). ONTARIO—14 ♂ ♀, June 23—July 15, 1915, Parry Sound (H. S. Parish). 2 ♀, June 11—14, 1913, Guelph; ♂, June 12, 1915, Simcoe (H. Caesar). ♂ 4 ♀, June 16, 1917, Strathroy (H. G. Crawford).

Labops tumidifrons new species.

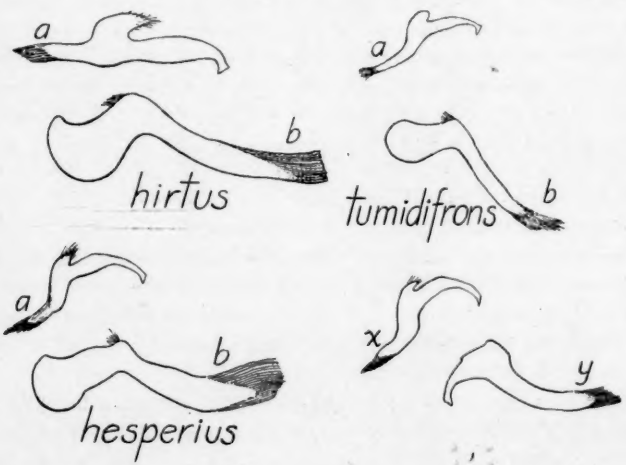
Male. Length 3.4 mm., width 1.3 mm. *Head*: width 1.17 mm., vertex .66 mm.; frons strongly convex, meeting the nearly horizontal vertex at a point just before front margin of eyes; clothed with erect pale hairs, longest on tylus,

front rather thickly covered with closely appressed, silvery, scale-like hairs; black, moderately shining, a white mark each side of vertex and extending mesad along base; juga white, much less prominent than in *hesperius*. *Rostrum*, length .97 mm., reaching to middle of hind coxae, black.

Antennae: black; segment I, length .36 mm.; II, 1mm.; III, .53 mm.; IV, .61 mm.

Pronotum: length .60 mm., width at base 1.14 mm., anterior angles .74 mm.; black, lower margins of pleura pale; clothed with erect pale hairs, intermixed with closely appressed, silvery scale-like hairs, the same extending to cover sides of thorax and abdomen; ostiolar peritreme black, scarcely paler along posterior margin; slenderly pale bordering base of intermediate coxae.

Hemelytra: fully developed, black, embolium and outer margin of cuneus pale, membrane uniformly blackish; clothed with erect, pale yellowish hairs, and intermixed with scale-like hairs, the latter thickest on clavus and corium.



Male genital claspers of species of Labops, a, left clasper, lateral aspect. b right clasper, lateral aspect. x, y, left and right claspers, y, showing aberrant form of right clasper in two specimens of *Labops hesperius*.

Legs: black, apices of femora, and tips of coxae, pale; femora beset with prominent erect hairs, pubescence on tibiae short, not equal to length of true spines.

Venter: black, clothed with erect pale yellowish hairs, the sides bearing scale-like hairs; genital claspers distinctive although showing a close relationship with *hesperius*.

Female. length 3.1 mm., width 1.4 mm.; brachypterous, hemelytra reaching to near tip of abdomen, cuneal fracture present but membrane scarcely developed; shape of head, pubescence, and color, similar to that of male although the body slightly more robust.

Antennae: segment I, length .34 mm.; II, .85 mm.; III, .50 mm.; IV, .61 mm. *Head*: width 1.2 mm., vertex .71 mm.

Holotype: ♂, June 15, 1920, Chilcotin, British Columbia (R. C. Treherne); Canadian National Collection. *Allotype*: taken with type; author's collection. *Paratypes*: 3 ♂, taken with the types.

Labops burmeisteri (Stal) has been recorded from this continent but the writer has not seen specimens that have been collected in North America. There is at hand for comparison and study, a specimen of *burmeisteri* determined by Reuter (♀, Shigansk, Lena infer. Russia, B. Poppius), which comes from a region near the type locality of the species. *Burmeisteri* comes nearest to *hirtus* but differs somewhat in form as well as in pubescence and color of the legs.

In the above figure, left and right genital claspers are illustrated, drawn from two specimens which in all other respects should be referred to *hesperius* Uhler. It seems worthy of remark that two specimens should be found, both showing the right clasper modified to a form very similar to the left clasper. The most logical explanation for these unusual specimens would seem to be that they represent a reversion of the right clasper back toward the primitive, bilaterally symmetrical form of clasper. In *Labops, Lopidea, Orthotylus,* and several other genera of Miridae, the left clasper is very little modified throughout the species in each genus. In other words, the left clasper is generic in character while the right clasper is indicative of the species. From this it would seem that the left clasper has remained more primitive while the right clasper exhibits great change in form with the development of new species. The above figured specimens of *Labops* seem to show that sudden reversion of the right clasper may take place, probably in a single generation, for among eighteen specimens of *hesperius* taken at the same time, all other male specimens were normal for the species. The writer has also found a single male of *Lopidea,* taken with a large series of *L. arizona*, which exhibits a similar condition of claspers. The right clasper is almost identical with the left clasper, or at least its bilaterally symmetrical counterpart. This specimen differs from the typical *L. arizona* in being much smaller, although quite similar in coloration. Thus we have two examples of species in different genera, each exhibiting reversion of the right genital clasper toward a more primitive form. The question naturally arises,—have not new species of plant bugs been created with the same sudden change, but by modification of the genital clasper in a different direction, or away from the bilaterally symmetrical type? The numerous species of the genus *Lopidea* would seem to support this view, yet nearly every species has its own particular food plant.

OXYHAEMOGLOBIN PRESENT IN BACKSWIMMER *BUENOA MARGARITACEA* BUENO (HEMIPTERA).

BY H. B. HUNGERFORD,

Kansas University, Lawrence, Kansas.

Some six years ago, while engaged in the study of the biology of the above named Notonectid, I discovered the presence of some blood red masses in the abdomen of these bugs. These masses are of such strikingly brilliant hue and so unusual in color for insect tissue that they led to a superficial examination at that time. They are grouped about the several tracheal trunks which have their connections with the abdominal spiracles opening in the ventral air groves. Each of these red masses is made of many very red, more or less oval cells, that appear bound together by the innumerable branchings of tracheae. These cells haemolyze quickly in distilled water but retain their red pigment contents in normal salt solution. The clusters of these cells about each tracheal trunk appear compound, and are of considerable size, so that the entire red mass fills much of the abdominal space. They lend their vivid color to the insect showing through the somewhat transparent tissues of the sides and dorsum of the abdomen and give the entire venter a very dark red color. I have noted[1] that the venter of the abdomen is deep red in living specimens and that it darkens in museum material. The fact that these bodies become very dark after death combined with my observations that Buenoa seldom comes to the surface of the water, but is content to poise and swim submerged, where the insect seems to be in perfect equilibrium, suggested to me the possibility that the red might indicate haemoglobin. These large clumps of red cells are most intimately connected with the respiratory system, and might well serve to fix and store the oxygen as a reserve supply. They are conspicuously present from the second instar on, and, indeed, are found in the abdomen of the embryo not yet hatched. In spite of the exceedingly interesting possibilities to be revealed by a study of these scarlet organs, it was only recently that a test was made for haemoglobin. The following tests were made with the assistance of Dr. N. P. Sherwood, Professor of Bacteriology, whose experience in blood tests was invaluable and whose interest in this problem has been as great as my own.

SPECTROSCOPIC TEST.

These red cells when placed in distilled water haemolyze readily, and the fluid thus obtained and examined with the Spectroscope shows very distinctly the two absorption bands between D. and E. Controls were run with sheep's blood and human blood.

TEICHMANN'S TEST FOR HAEMIN CRYSTALS.

The technique suggested by Teichmann was used and definite brownish crystals were consistently obtained. Proper controls were run to guard against faulty technique.

In addition to the above Spectroscopic and Hæmin crystal tests, chemical tests such as Weber's Guaiac test for blood gave positive reactions.

All of these tests were clearly positive, and we are thus able to report that we have in this case an insect containing definite, bright red clusters of cells,

1—Hungerford, H. B.—Biology and Ecology of Aquatic and Semiaquatic Hemiptera—Kansas University Science Bulletin Vol. XI, pg. 194, 1919.

enmeshed and closely associated with the tracheal system of the abdomen, which contain oxyhaemoglobin.

In the case of Chironomus (the blood worm), which has been cited frequently as the only insect possessing hæmoglobin, the red fluid is free in the body cavity, and when the larva is punctured flows out at once. Rollet[2] in 1861 discovered hæmoglobin crystals in this pigmented material and Lankester[3] in 1867 noted that it gives the characteristic absorption-spectrum of hæmoglobin—Cuenot[4] 1891 who investigated the blood and lymphatic systems of many vertebrates and invertebrates is often cited in connection with the above case. A case more interesting and structurally more like the one I am reporting, is that of the larva of *Gastrophilus equi*. Berlese[5] gives a discussion of the literature relating to the discovery and study of certain pink cells related to the tracheal system in these Bot fly larvae. He cites Vaney[6] as showing that the red color of these "cellules tracheales" is due to hæmoglobin which he appears to have thought was secured in some manner from the host. Vaney found further that the hæmoglobin tended to disappear following the larval period. Both the above mentioned records are in the Diptera. We are pleased, therefore, to report the presence of oxyhaemoglobin in definite cell clusters in the free swimming Aquatic Hemipteron *Buenoa* and to suggest that it is, no doubt, present also in the closely allied genus, *Anisops*. Since these insects are not parasitic, the hæmoglobin is produced by them, and has a normal physiological function to perform.[7]

ON THE GENUS ELIDIPTERA (HOMOP.)

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In a recent number of the Canadian Entomologist (Vol. LIV:61) Mr. Muir calls attention to the fact that an examination of *Elidiptera callosa* Spin. from Trinidad, the logotype of the genus *Elidiptera* Spin., shows that our North American species assigned to *Elidiptera* by Van Duzee (Cat. N. A. Hemip. p. 726) do not belong to this genus. Muir says that certain species will "fit into *Angeleusa* Kirk. (*Argeleusa* Kirk.) and have a distinct median carina on the clypeus." However, I cannot agree that our Eastern North American species belong to *Argeleusa* which has the following characters that do not agree with our species. "Vertex basally distinctly angulately emarginate; not impressed; tibiae obscurely spined near the base," etc.

I do not believe that the median carina on the clypeus is a reliable character in this genus as some of our species (*opaca* Say) have a very distinct median carina, while other species (*slossoni* Van D. and *variegata* Van D.) have a fainter carina. In certain other species (*pallida* Say and *septentrionalis* Prov.) the median carina on the clypeus is almost wanting.

2—Rollett, A. Zur Kenntniss der Verbreitung des Haematin—Sitzungsb. Wien. Akad. XLIV, pp. 615-630. 1845.
3—Lankester, E. R. A contribution to the knowledge of Haemoglobin—Proc. Roy. Soc. XXI, pp. 70-81. 1873.
4—Cuenot. Etudes sur le sang et les glandes lymphatiques dans le série animale—Arch. Zool. exper. et gen. 1902.
5—Berlese, A. Gli Insetti pp. 769 and 822. 1909.
6—Vaney, C. Contribution á l'étude des larves et des métamorphoses des Diptères. Thése de Lyon—Ann de l'Univ. de Lyon. Nouv. sér. 7.
7—A complete study of the histology and development of these interesting cells is under way.

In casting about for a name to take the place of *Elidiptera* we find that Amyot and Serville (Nat. Hist. Ins. Hemip. p. 526) propose *Helicoptera* on the basis that it expresses in more correct Greek the idea of the overlapping wings which Spinola tried to express by his name *Elidiptera*. They describe *Elidiptera cincticeps* Spin. only under *Helicoptera* and list *E. marginicollis* Spin., *E. advena* Spin. and *E. callosa* Spin. *E. cincticeps* might therefore be considered the type of the genus *Helicoptera* but according to Banks and Caudell, Entomological Code rule 105; "the type of a new generic name which by sign or language is clearly shown to be proposed to replace another valid generic name is the same as that of the genus replaced," and since, Entomological Code rule 86, emendations such as this are not permitted, *Helicoptera* becomes a straight synonym of *Elidiptera*. It is doubtful if *Helicoptera* with genotype *E. cincticeps* would be available anyhow, as Spinola states in the original description of *cincticeps* "En differe (from the other species of *Elidiptera*) par l'absence totale d'une arete mediane sur la face frontal."

With these points in mind, therefore, I propose the name *Epiptera* for this genus, which may be described as follows:

Epiptera new genus.

Orthotype, *Falta opaca* Say.

This genus may be recognized by the narrow head with projecting vertex, by the rather long pronotum and overlapping wings.

Head narrow, not over half as wide as the pronotum; vertex projecting in front of the eyes, with carinated margins, median line sulcate, posterior margin broadly arched; frons and clypeus together about eliptical; frons narrowed above between the eyes widened gradually to near the clypeal margin and then contracted, laterally and medianly carinate; clypeus more than half as long as the frons; medianly and laterally carinate, the former sometimes faint; second joint of antennae terrete about three times as long as the first; basal knob of the flagellum rather distinct; flagellum short, about twice as long as the segments of the antennae; compound eyes elongate; ventral sinus inconspicuous; ocelli conspicuous, placed below the compound eyes anterior to the antennae; pronotum projecting triangularly between the compound eyes; the margins of this triangle carinate with these carinae extending almost to the posterior margins; posterior margin deeply triangularly notched with the anterior and posterior margins about parallel; the lateral lobe of the pronotum is quadrate nearly twice as long as broad; mesonotum tricarinate, nearly three times as long as the pronotum; legs simple; anterior femora and tibiae nearly equal; posterior tibiae approximately twice as long as the femora; with a single strong lateral tooth beyond the middle; basal joint of the posterior tarsi nearly twice as long as the second and third combined; claws strong; fore wings opaque, overlapping apically, venation distinct, subcosta and radius united basally; subcosta two with many accessory branches between it and costal margin; radius with a few similar branches; medius typical, four branched, some of which branch again before the apical margin; cubitus two branched, with several accessory veins before the apical margin; the cross veins connecting the branches of the various veins form a crenulate submarginal vein; second and third anals united about two-thirds of the distance from the base of the clavus; the common stem running to the apex of the clavus.

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